XVII. DESCRIPTIONS OF SOME NEW SPECIES OF FISHES AND MISCELLANEOUS NOTES ON OTHERS OBTAINED DURING THE EXPEDITION OF THE CARNEGIE MUSEUM TO CENTRAL SOUTH AMERICA.

By John D. Haseman.[1]

Some of the species of the *Pygidiidæ* called "Candiru" are said to live as parasites in the branchial cavities of the larger siluroids. In fact they attach themselves to any kind of fish or animal, including man. By means of suction, for which their mouths are adapted, they fasten themselves to their victim, and then painlessly cut the skin, and gorge themselves upon its blood. The fishes brought into the market at Manaos often show many wounds inflicted by the Candirus. Below the first fall in the Madeira River it is difficult to take a catfish which has not been bitten several times by the Candirus. In a creek called Igarape Irura, near Santarem, I collected four hundred specimens of Candirus (*Stegophilus*) buried in the sand. They are minute and could be seen by the millions in this locality, where the water was too shallow to permit the presence of large fishes of any kind. The fishes belonging to the genus *Vandellia*, as well as to other genera of the *Pygidiidæ*, lie buried in sand-bars, and I have often seen them when disturbed rise like a flash and bury themselves again in an instant, leaving a small round hole where they re-entered the sand.

Geophagus brasiliensis and *surinamensis* have been found in brackish water. I saw one individual of *G. brasiliensis* taken from the sea near Santos. Near Iguapé I put specimens of *Acestrorhynchus hepsetus*, *Geophagus brasiliensis*, *Astyanax rutilus*, *Hoplias malabaricus*, and *Pœcilia vivipara* into sea-water. Naturally the pœcilids were not affected. They normally live in both salt and fresh water. *Acestrorhynchus* and *Hoplias* died in a short time. *Astyanax rutilus* lived for about an hour. *G. brasiliensis* was at first somewhat restless and puffed up, but later on it did not appear to suffer from the sudden change from fresh to salt water. It lived several hours in a bucket of sea-water.

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[1] This is the third paper relating to the Expedition of the Carnegie Museum to Central South America.

Electrophorus electricus (Purakee).

I have often seen electric eels along the rocky ledges of the Guaporé, Marmoré, and upper Madeira Rivers, coming to the surface and emitting air. This was observed in the morning and evening They rise almost vertically and begin making large air-bubbles before their snouts protrude from the water. They delay only an instant before descending again.

An Indian shot a specimen five feet long with an arrow, and I swam in after it. I pulled it to the sandy margin of the river and while it was still covered with water I passed my hand three times over the entire body of the dying eel. The shock I felt was acute, but far from being a stunning blow. While I was removing it from the water and putting it into a dip-net made of copper wire it wriggled against the wire, and I received all of its voltage and fell helpless on the moist sand. A series of terrible shocks continued so long as the eel remained on my bare legs and I could not let go of the dip-net. The Indian relieved me by pulling the eel away by means of the arrow, which still remained in its head. I never saw a fish killed by an electric eel, and I do not believe that they are capable of doing this in a river. The shock appears to be only a protection.

Pimelodella transitoria (Mir. Rib.) is a synonym of *Pimelodella lateristriga*.

Lophiosilurus alexandri Steindachner.

No. 2881. One specimen, 6.5 cm. long. Cidade da Barra, Bahia, Rio São Francisco, Dec. 6, 1907.

" 2878. One specimen, 20.5 cm. long. Joazeiro, Bahia, Rio São Francisco, Nov. 28, 1907.

" 2879. One specimen, 28.5 cm. long. Penedo, Alagoas, Rio São Francisco, below Paulo Affonso Falls, March 20, 1908.

This species, well represented by the three specimens cataloged above, is peculiar to the basin of the Rio São Francisco.

CEPHALOSILURUS, gen. nov.

Head large, not as flattened as in *Lophiosilurus;* lower jaw slightly protruding; dorsal and adipose fins well developed and high; occipital crest not exposed as a triangular shield, with a narrow bony stay to the base of the dorsal; otherwise like *Lophiosilurus.*

Cephalosilurus fowleri sp. nov.

(Plate XLVI.)

Type (unique).—No. 2880. 310 mm.[2] Cidade da Barra, Bahia, Rio São Francisco, Feb. 25, 1907.

Locally known as Pocoma. Larger, more slender, and less compressed than *Lophiosilurus alexandri* Steindachner. The lower jaw does not protrude so much and the barbels are twice as long. The dorsal and adipose fins are twice as high and without triangular bony ridges on the head, as in *Lophiosilurus alexandri.* D. I. 6; A. 8; P. I. 6; head 3.16 in the length of the body, longer than broad; depth at the origin of the dorsal 5.5 in the length; longest dorsal rays one-half as long as the head; pectoral spine two-thirds the length of the head, both margins with teeth; eyes small without distinctly free margins; mouth

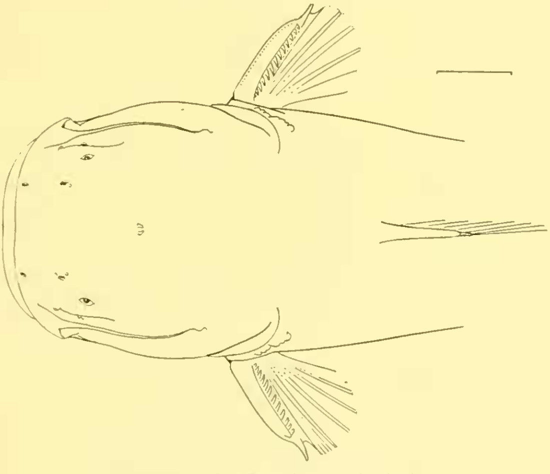

FIG. 1. *Cephalosilurus fowleri.*

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[2] The measurements of length given in the text are to base of caudal. On plates the full length is generally given.

large; a broad band of teeth in each jaw; postmental barbels about one-half as long as the maxillary barbels, which extend to the gill-cleft; gill-membranes separate, and joined only to the front edge of the isthmus, as in *Lophiosilurus;* head covered with skin, without exposed bony ridges; occipital process extending to the dorsal plate; lateral-line organs well developed, as in *Lophiosilurus;* the anterior portion of the body depressed and the caudal portion compressed; the caudal round; the skin on the dorsal and lateral sides covered with papillæ and short hair-like projections; the color above and below brown; many black spots on the sides, back, and fins.

I take pleasure in dedicating this species to Mr. H. W. Fowler.

Imparfinis mirini, sp. nov.

(Plate XLVII.)

Type.—No. 2981. 8.3 cm. long. Near Piracicaba above the falls of the Rio Piracicaba-mirini, September 7, 1908.

Cotypes.—Nos. 2982 *a–d*; 5–7 cm. long. From same place, taken at same date.

Cotypes.—Nos. 2983 *a–c*; 5.5–7 cm. long. Same place and date, but from below the falls, which are twenty feet high.

A. 10; D. I. 6; head about 5; depth 6; eye 2.5 in snout, 2 in the interorbital space, 5 to 6 in the head; caudal portion of body compressed; head conical, being almost as deep as wide, and two-thirds as wide as long. No free orbital margin; weak dorsal and pectoral spines with soft tips; mental barbels extending almost to base, and postmentals slightly past base, of pectorals; maxillary barbels to, or beyond, the tip of pectorals; ventrals inserted below the middle of dorsal; practically no dorsal plate and very minute occipital process; the adipose is longer than the anal and equals the distance between the dorsal and adipose; caudal forked; color almost uniform light brown, with some dark edges on fins. Two specimens have bases of caudal black and some indistinct blotches on the back. This species is easily distinguished from *Imparfinis piperatus* by its conical instead of depressed head.

This species lives under stones in rapids.

Imparfinis transfasciatus (Ribeiro) and *Rhamdiaglanis frenatus* (R. Von Ihering) are synonyms of *Imparfinis piperatus.*

I have examined the types of all of these species.

Bunocephalus depressus, sp. nov.

(Plate XLVIII, fig. 1; Plate XLIX.)

Type (unique).—No. 2984. 5.5 cm. Rio Machupo, near San Joaquin, Bolivia, September 6, 1909.

D. 5; A. 11; P. I. 4; C. 9; distance from tip of snout to base of dorsal goes 2.8 in length of body; maxillary barbels extending slightly past base of pectorals, and postmentals extending to the gill-opening; pectoral spine with hooks on both margins about as long as the width of the spine; spine equal to the distance from the tip of snout to the base of the pectorals; head gently depressed, with no prominent knobs; eyes small and about one-third of the interorbital space, which is equal to the length of the snout; mouth small, upper jaw longer than the lower, snout rather pointed; width at base of pectorals greater than the length of the head and one-fourth of the length of the body, greatest depth one-eleventh the length of the body; coracoid process shorter than the humeral process, neither of which is very long; no warts or papillæ on the skin; uniform light brown in color, about six minute dark spots or pores along the sides.

This species is easily recognized by its greatly depressed body, the eleven anal rays, and by the long post-dorsal portion of the body.

ACESTRIDIUM, gen. nov.

Tip of snout expanded, disc-like, and provided with long spines; D. .7; all of scutes provided with many series of delicate spiny ridges and depressions. Otherwise like *Farlowella*.

Acestridium discus, sp. nov.

(Plate L, fig. 1; Plate LI.)

Type.—No. 2985. 7.2 cm. over all. Igarapé de Cachoeira Grande, near Manaos, Brazil, Nov. 30, 1909.

Cotypes.—No. 2986, a–b, 6 and 5 cm. Same place and date as type.

Tail posteriorly depressed, with a single series of plates on the sides; dorsal fin inserted over the anal; no adipose; abdomen without a median series of plates; upper angle of gill-opening slightly nearer the origin of dorsal than the tip of the snout; length of the produced snout about 4 in the distance from its tip to the anus; tip of snout with an expanded spiny disc; eye 4 in interorbital; head 3.5 in body; breadth of head 3.5 in its length; all scutes with many delicate keels; D. .7;

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A. .5; twenty-five to twenty-seven lateral scutes; five scutes between the supra-occipital and the dorsal plate, color light brown, with a few indistinct spots on the fins and a faint band back of the eyes.

This species is easily recognized by the expanded snout and many delicate keel-like ridges on the scutes.

All the specimens were collected in a grassy, cool, shady, swampy creek known as Igarapé de Cachoeira Grande, near Manaos, November 30, 1909.

PLATYSILURUS, gen. nov.

Teeth all alike, and those on the vomer in two patches; upper jaw slightly longer, head more or less conical, not greatly depressed; fontanel continued behind the eyes as a deep groove, which is continued into the dorsal plate, which is firmly joined to the occipital process; snout rather long and somewhat pointed; head almost twice as long as broad; caudal deeply forked, the lower lobe broader and longer; a bony process back of upper angle of gill-opening ending in a few roughened plates on the anterior part of the lateral line.

The single species of this genus resembles *Platystomatichthys sturio* in nearly all details, excepting the stronger dorsal and pectoral spines, the much shorter and less pointed snout, and the larger eyes.

Platysilurus barbatus, sp. nov.

Type.—No. 2987. 17.5 cm. São Antonio de Rio Madeira, Nov. 3, 1909.

Cotypes.—Nos. 2988 *a–c*. 9.5–12.5 cm. Rio Machupó, near San Joaquin, Bolivia, September 6, 1909.

D. .6; A. 11; P. .9; head 3.33; depth at origin of dorsal 6; first rays of anal three times as long as the last; adipose of greater extent than the anal, and about equal to the distance between it and the last dorsal ray, two and a half times as long as high; caudal peduncle short and almost round; pectoral spine longer than the dorsal, three-fourths as long as the head and denticulated on both margins; dorsal spine denticulated on the posterior margin; eye 6 in head, about 3 in the snout, 1.25 in the interorbital space; humeral process rather short and spine-like; maxillary barbel three times as long as the body, its proximal part wire-like; post-mentals extend to middle of pectoral; lower caudal lobe fully one-third as long as the body; head broader than deep; snout tapered and sub-conical; top of head bony and striated; upper part of sides dusky, with a large dark median lateral spot below the dorsal, and five or six smaller round black spots about the size of the eye along either side of the adipose and the upper caudal lobe; ventral side white; lower caudal lobe black.

The cotypes are less highly colored and have shorter maxillary barbels.

Kronichthys subteres (Ribeira) is a synonym of *Hemipsilichthys gobio* (Lütken).

Dysichthys australe Eigenmann is a synonym of *Bunocephalus rugosus.* They have three pairs of barbels and are identical in all other details. *Dysichthys australe,* as well as Cope's *Dysichthys coracoideus,* are based on small specimens in which the mental barbels are very small and were overlooked. As the specimens grow the mental barbels increase considerably. I have examined the type of *Dysichthys coracoideus* (Cope). It has three pairs of barbels, and I consider it the same as *Bunocephalus bicolor.*

I was unable to find any differences between the fishes known by the natives as "Jahu" found in the upper affluents of the Rio de la Plata and those found in the various falls of the Rio Madeira. Specimens less than two feet in length are, as a rule, more or less spotted, and have a velvety yellowish color, while the large adults are almost black in color and are nearly always found in and below waterfalls. Medium-sized and young specimens are oftener found in deep water some distance below waterfalls. Hence *Platystoma lütkeni* Steindachner and *Paulacea jahu* Von Ihering should stand as *Paulacea lütkeni* (Steindachner).

There are some individual and local variations in the genus *Salminus,* and the young are somewhat different from the adults; but I am unable to draw any distinction between the various species described from the São Francisco, Rio Grande do Sul, and the La Plata basins. Hence I consider all of the species to be *Salminus hilarii.* The genus is not found in the Amazon basin and I doubt if *Salminus affinis* (Steindachner) belongs to this genus.

I have not seen any specimens of *Phreatobius cisternarum* (Gœldi), but from the description and the habitat assigned I am inclined to believe that it is a very small *Pygidium amazonicum* (Steindachner).

THE BREEDING HABITS OF THE GEOPHAGINÆ.

The *Geophaginæ* have a lobe on the upper branch of the first gill-arch, which is supposed to be associated with the retention of the eggs during the period of incubation. The lobe exists, but it is not used to secure the eggs. I found the eggs of *Geophagus brasiliensis* in the Rio Itapicurú. They were placed in nests similar to those of the North American sun-fishes. The eggs of all the species of this genus are small and numerous, in great contrast to those of species which carry their eggs in the mouth. I took eggs out of the mouth of *Tachysurus barbus*, but these eggs were one-fourth to one-half of an inch in diameter, and were contained loosely in the mouth. Besides, I did not see more than about twelve eggs in any one mouth; however, I was told that as many as two dozen are found in large individuals. *Osteoglossum bicirrhosum* also retains its eggs loosely in a pouch-like depression formed by the elastic skin which connects the bones of the lower jaw. But its eggs are few (less than two dozen) and about one-fourth of an inch in diameter.

I found one specimen of *Geophagus brasiliensis* which had a peculiarly tuberculated first gill-arch. It appeared to have eggs imbedded between the gill-rakers, but the egg-like structures were abnormal growths. Many species of *Geophagus* protect their young in their mouths. In the Rio Jacuhy I saw many young *Geophagus gymnogenys* swimming about a medium-sized female along a sand-bar. When I attempted to catch them, they nearly all disappeared in the mouth of the mother. When I retreated I saw the young swimming about the mother again. I could not have been deceived, because there were no stones and grass in which they could hide and they do not bury in hard sand. After observing them for some time, I netted the mother, and found her mouth entirely full of young fishes of the same size as those seen swimming about. She began to eject the young as soon as she was out of the water. I have found eggs in the mouths of various families of fishes, but these eggs either came from ripe ovaries placed in the killing-bucket or were being eaten or were sucked in during the respiratory process a short time before the specimens were killed, I saw no specimens of *Geophaginæ* in which the mouth-cavity was used to incubate the eggs, and I observed a very large number of specimens.[3]

Typhobagrus kronei (Ribeiro).

In every character these blind cat-fishes agree with *Pimelodella lateristriga*, except that their eyes appear to have been gouged out, the sockets having been retained.

D. I. 6; A. 12; depth about half the length of the head, which is not quite one-fourth the length of the body; pectoral spine with ten teeth, which are about one-half the width of the spine; snout not pro-

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[3] In view of what Mr. Haseman says the following quotations concerning the breeding-habits of American *Geophaginæ* will be of interest:

Castelnau says of *Retroculus lapidifera*, "Au lieu de l'abandonner au sien des eaux, ce qui est le cas presqu'universel des poissons, celui-ci porte une à une dans sa bouche et à une assez grande distance sur le rivage de petites pierres dont il forme un lit dans lequel il dépose des œufs."

Hensel writes as follows (*Wiegmann's Archiv für Naturgeschichte*, 1868, 669): "Die Gattung *Geophagus* ist durch höchst merkwürdige Eigenthümlichkeiten in ihrer Brutpflege bekannt, und zwar scheint es das männliche Geschlecht zu sein, welches sich durch eine besondere Aufmerksamkeit für die Brut auszeichnet. Ich habe Gelegenheit gehabt, ähnliches auch bei *G. scymnophilus* zu beobachten. Leider war der Sommer schon zu weit vorgerückt (December), um das Laichen selbst zu sehen. Ich muss es daher unentschieden lassen, ob der Fisch ein besonderes Nest baut, oder ob er die Eier in der Mundhöhle ausbrütet. Dagegen gelang es mir sehr häufig, die Sorgfalt zu beobachten, mit welcher das Thier, wahrscheinlich das Männchen, die Jungen beschützt und leitet. Zu der Zeit, in welcher diese noch sehr klein sind, hält sich der alte Fisch in den seichten Gebirgsbächen auf, wo das Wasser hell und rein über die Geschiebe dahin fliesst, und wo er auch wahrscheinlich laicht. Hier nun findet man ihn an besonders flachen Stellen in der Nähe des Ufers, wo das Wasser durch locale Hindernisse aufgehalten, ganz ruhig erscheint, wo die Steine mit grünen Algen überzogen sind, und der Boden reichlich mit Schlamm bedeckt ist. Hier schwimmt die Heerde der Jungen vielleicht aus 20–30 Stück bestehend sorglos umher, während der Alte in einer Entfernung vorsichtig Wache hält. Zeigt sich nun irgend eine Gefahr z. B. ein plötzlich herantretender Mensch, so erscheint der Alte schnell unter der Heerde und giebt ihr wahrscheinlich ein Zeichen. Alle Jungen versammeln sich wie auf Commando an dem Maule des Alten, das sie wie ein Bart umgeben, blitzschnell verschwinden sie alle zusammen in ihm, und ehe man es hindern kann, hat sich der Alte weit mit ihnen entfernt. Behält man ihn im Auge, so sieht man wie er bald eine Stelle, ähnlich der verlassenen aufsucht und hier seine Jungen aus ihrem Gewahrsam wieder entlässt.

"Hat man den Fisch von weitem beobachtet, was bei der Klarheit des Wassers duced; teeth in two bands of about equal width in each jaw; maxillary barbels not extending to the adipose; post-mental barbels extending beyond base of pectoral, and mental barbels not reaching the base of pectorals; dorsal spine slightly nearer to the tip of the snout than to the origin of the anal; dorsal spine about half the length of the head,

leicht ist, so gelingt es nicht selten durch Vorsicht so nahe heran zu kommen, dass man durch schnelles Zufahren, mit einem Netz z. B., zwischen den Alten und seine Jungen gelangt, und diese in der Bucht isolirt. Sie schwimmen dann in einen Haufen zusammengedrängt in dem kleinen, ihnen übrig gebliebenen Raume hin und her und harren der Hilfe des Alten, während dieser ausserhalb unruhig auf eine Lücke lauert, durch die er seine Jungen entführen kann. Er vollführt das so schnell und vorsichtig, dass es mir trotz aller Mühe niemals gelungen ist, ihn mit den Jungen im Maule durch das Netz zu fangen. Erst dadurch, dass auf seiner Flucht dicht neben ihn ein starker Schuss in's Wasser abgefeuert und er auf diese Weise getödtet oder betäubt wurde, gelang es mir ein Exemplar mit der Brut in der Mundhöhle zu erhalten. Die Jungen liegen darin dicht gedrängt, mit den Köpfen nach den Kiemen hin gerichtet."

Von Ihering (*Die Süsswasser-fische von Rio Grande do Sul*, 1893, 61) adds: "Ein grosses Exemplar des *Geophagus brasiliensis* beobachtete ich bei Pedras Brancas, wie es über seinem als eine flache Grube in ca. 1½ Meter tiefem Wasser in dem Boden gearbeiteten Neste Wache hielt, ohne sich vertreiben zu lassen. Doch gelang es nicht ihn zu fangen, und bleibt es zu untersuchen, ob es das Weibchen ist, welches die Brut pflegt. Beim Bagre sind es beide Geschlechter."

Mrs. Agassiz says (*A Journey in Brazil*, 1893, 241) of some species of this subfamily: "These specimens furnished a complete embryological series, some of them having their eggs at the back of the gills, between the upper pharyngeals and the branchial arches, others their young in the mouth in different stages of development, up to those a quarter of an inch long and able to swim about, full of life and activity, when removed from the gills and placed in water. The most advanced were always found outside of the gills, within the cavity formed by the gill-covers and the wide branchiostegal membrane. In examining these fishes Mr. Agassiz has found that a special lobe of the brain, similar to those of the *Triglas*, sends large nerves to that part of the gills which protects the young, thus connecting the care of the offspring with the organ of intelligence. The specimens of this morning seem to invalidate the statement of the fishermen, that the young, though often found in the mouth of the parent, are not actually developed there, but laid and hatched in the sand. The series, in these specimens, was too complete to leave any doubt that in this species at least the whole process of development is begun and completed in the gill-cavity."

I am told, though I have not been able to verify the statement, that the habit of entering and leaving the mouth on the part of some American *Geophaginæ* has been observed and photographed in some of the European aquaria. Attention may be called to the often recorded observation that eggs are carried in the mouths of African Cichlids. Such an incident is figured by Pellegrin in the work used by Mr. Haseman while preparing this paper.—Carl H. Eigenmann.

with teeth on the front edge of its tip; caudal deeply lobed, the upper lobe the longer, about one-fourth the length of the body; the depth of the caudal peduncle not quite one-third the length of the head; usually a dark band along the sides; tips of the dorsal fin sometimes dark. In some specimens the head is more depressed than in others, and the band of teeth in the lower jaw is relatively wider. Nearly all specimens have pits under the head. The sense of touch is acute, and they swim away rapidly when disturbed.

The exit of the cave in which they were found is stopped up, and the water spurts up through the sand and rocks like a fountain. The cave has a break in its roof quite like that at the Twin Cave, Mitchell, Indiana, differing in that there are high mountains on all sides. The mouth or exit of this cavern appears to have been stopped up for a long time. The overhanging roof and cliff have caved in. This blind cat-fish has been known for a long time to the inhabitants of Iporanga under the name of "Ceguinho." They eat them. *Pimelodella lateristriga* is called "Mandy-tinga." The blind cat-fish is said to occur in only one of the forty or more caves of this region.

The erection of a new genus for the reception of this fish, which is indistinguishable from *Pimelodella lateristriga* except by the loss of the power of vision, does not appear to me to be proper. In my judgment it should be designated as *Pimelodella lateristriga* var. *kronei*.

A BLIND *Aglea intermedia* AND ITS ORIGIN.

On December 27, 1908, I collected specimens of *Aglea intermedia* in a cave called Caverna das Areas. It is near Agua Quente on the Atlantic slope of the Serra do Mar, in the upper course of the Rio Ribeira da Iguapé. The specimens were taken near the origin of the left branch of the cave, about two miles above the break in its roof, and almost seven miles from the exit of the cave which is known as Bombas. There are several sink-holes entering this cave, but they are all high up in the mountains.

I have refrained from describing these crabs as new, even though they can easily be distinguished from the parent form, which lives outside of the cavern. They have almost lost the natural bluish tinge, have more hair and longer antennæ, fewer spines on the carapace, and the black part of the lens is reduced to about one-fourth of its original size. In life they showed no sign of being able to see.

I took six specimens. I took one small specimen, but my guide let it escape before I had an opportunity to narrowly examine it. They were rare, and were seen in only one place. They had never been observed by the natives in any of the caves.

The parent crab of the cave form is apparently no better adapted to and does not avoid the sunlight any more than any other fresh-water Brazilian crab. I caught this species of crab along with two others and three species of fishes in the entrance of another cave, but they were not beyond the reach of direct sunlight.

I cannot explain the origin of *Typhlobagrus kronei* and of these blind crabs in any other way than through accident. The ancestors of both these forms are known, and are living on the outside of the caves.

I have entered many caves in Cuba, the United States, and in Brazil, and I think that Lankester's view of cave-life has more to support it in nature than the view expressed by Dr. Eigenmann in his book on cave vertebrates. On page 12 Eigenmann states that in view of the fact that six or seven of the eight known *Amblyopsidæ* are cave-dwellers and only one other species of the numerous North American fishes lives in caves, the Lankester accident theory is absurd.[4]

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[4] I do not comprehend Mr. Haseman's mental attitude. He certainly did not read with any care what I published. Concerning Lankester's accident theory of the origin of cave animals, I say (*Cave Vertebrates of America*, 1909, 12):

"While this is a possible mode of origin of cave-animals, and even of blind ones, it is highly improbable that many, or even any, animals depending, as he supposes, on their eyes, have come to first colonize the cave. Fishes are annually swept into caves, but these are not able to permanently establish themselves in them. To do this the fish must have peculiar habits, special methods of feeding and mating, before an accidental colonization can become successful, and if they are so adapted for a cave existence, they would probably voluntarily colonize the caves, without waiting for an accident. The *Amblyopsidæ* are a small family of fishes, eight species being known. They form a very small part of the large fish-fauna about the North American caves. But since six, possibly seven, of the species of this family are cave-dwellers, and only one of the numerous other fishes is permanently at home in the caves, we must suppose, if the theory under consideration is the correct one, that the accident of being carried into the caves happened to six or seven out of the *Amblyopsidæ*, and to only one of all the other fishes about the caves. The absurdity of this supposition is self-evident." Again, on p. 15: "It must also be evident that a fish depending on its sight to procure its food can never become a cave form. Sun-fishes, which are annually carried into the present fully developed caves, belong to this class of fishes. They are always poor when found in the caves, and will never be able to establish themselves in them. On the other hand, there is no reason why fishes detecting the prey either by smell (or taste) or touch

But Eigenmann's view is more absurd and faulty in explaining the absence of blind fishes in the numerous caves of eastern Greene County, Indiana, which are drained by the west fork of White River. At any rate the blind cat-fish and the crab with reduced eyes found in Brazil must either have been stopped up in the entrance of the cave when the overhanging roof fell, or have been washed in accidentally through some sink-hole and have been unable to get out. I do not doubt that other forms have likewise been either washed in or stopped up in the same cave, but they have either found their way out, or have been exterminated. If the cat-fish voluntarily entered the cave it is surprising that it has not also entered the caves of Sete Lagoas, Minas, Santa Abreu, Bahia, and the numerous other caves of the Iporanga district. In the upper course of the Paraguay I caught *Rhamdia quelen* and *Characidium fasciatum* in the entrance of a cave; but where there is and always has been an easy exit, they find their way out and no blind forms are found.

The condition of the blind crab and blind fish leads one to infer that they have not been relatively long dwellers in that cave. The age of this part of Brazil leads one to infer that these caves are very old, but until erosion had played its part they would not have been accessible to aquatic forms.

The idea that cave forms originally lived under rocks, or avoided light and were thus prepared for cave-life does not find any support in the Brazilian blind fish. The majority of mailed cat-fishes and *Pygidiidæ* are found under cover during the day, while the parent of the blind cat-fish lives as much in the open as any cat-fish, and seems to prefer the grassy margin of the streams. It has very sharp pectoral spines, which inflict painful wounds, and does not need to hide.

It appears to be nothing more than a rapid specific adaptation that has enabled the *Aglea intermedia* with reduced eyes and *Typhlobagrus kronei* to be able to exist in the cave, while the other forms, which might have entered the cave at the same time by accident, have been exterminated.

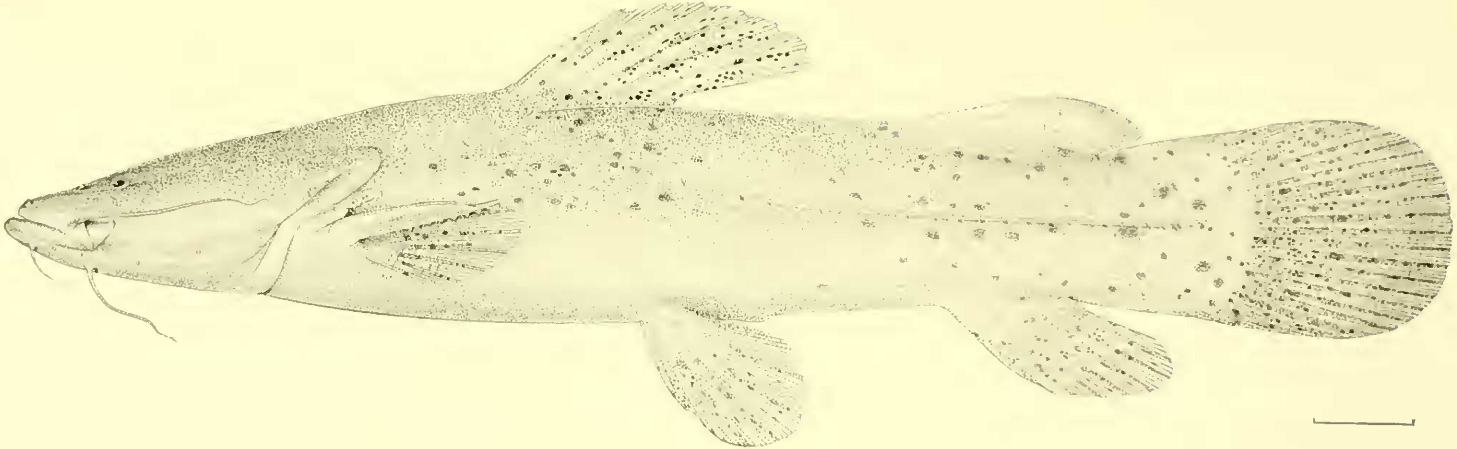
should not be capable of colonizing caves. The *cat-fishes* and *Amblyopsidæ* belong to the latter class. *It is surprising that more cat-fishes have not established themselves in caves.*"

It must be evident from the above that it is no surprise to me that this cat-fish is found in the caves. Whether it was carried in by accident or not is of no consequence. Its long barbels and the peculiar taste organs of cat-fishes put it among the possible candidates for cave-existence.—C. H. EIGENMANN.

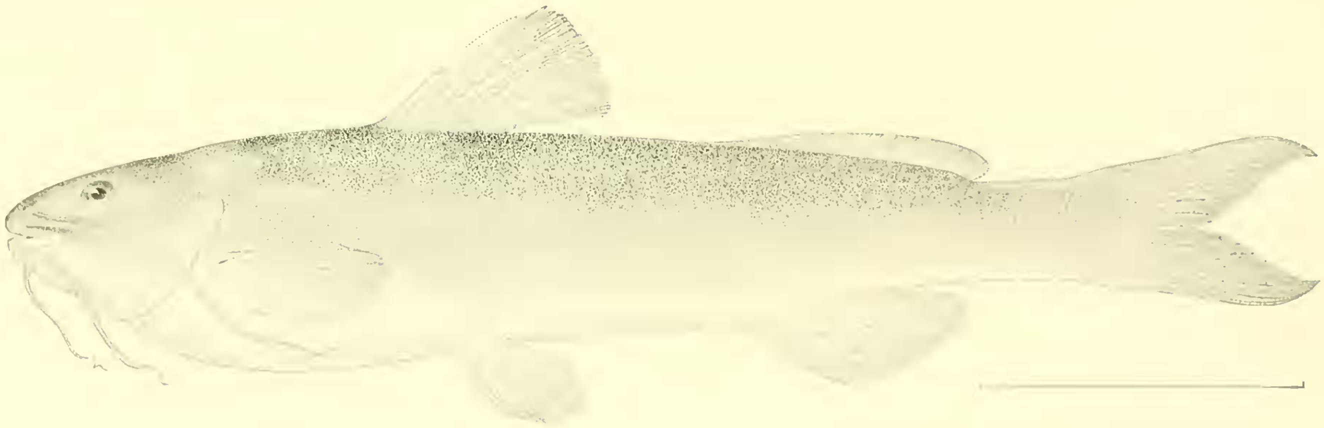
It is generally accepted that Cuba once had surface streams which later became subterranean. The Twin Caves at Mitchell, Indiana, are formed by a cave-in of a part of the roof which formerly covered a continuous underground stream. A similar cave-in has taken place in the case of the Caverna dos Areas, near Iporanga, Brazil, which in addition has its exit stopped up by large rocks and other débris. In fact all of the caves in which blind fishes have been found show abundance of evidence that radical transformations have taken place in their channels during bygone days; while caves like those of Santo Abreu Bahia, of São Luiz de Caceres and Coimbra, Matto Grosso, San Matias, Bolivia, Cavernas do Lagoa Santa, etc., of Minas Geraes, Gruta de Alambary, Gruto do Monjolinho, Gruta da Arataca, etc., of Iporanga, Brazil, and the numerous caves of eastern Greene County, Indiana, appear to have sufficient food and other favorable conditions for blind fishes, but none of these caves exhibit any signs of radical changes in their channels. Hence it appears that all caves which have had unobstructed channels and mouths with ready exits and entrances have no blind fishes.

In view of these facts it appears that the "accident theory" is the most probable explanation of the origin of blind fishes in the caves.

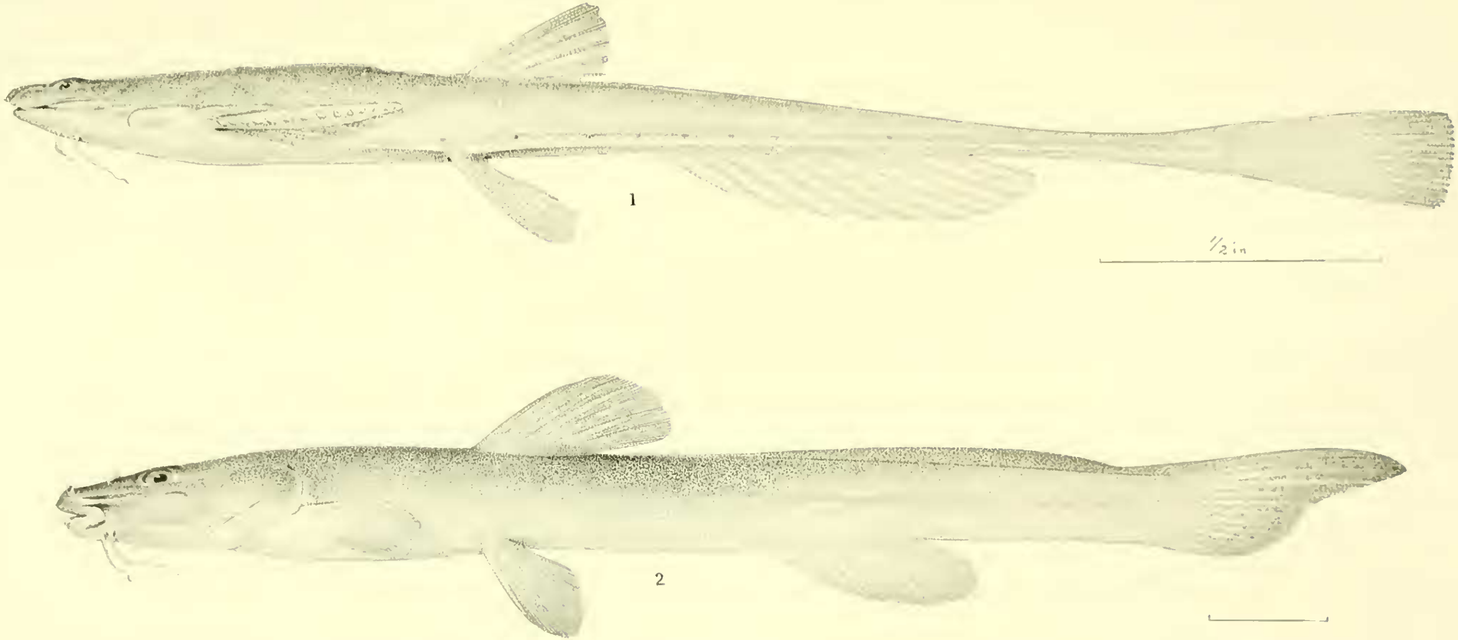
I think that the Iporanga cave region would be the most fruitful place in the world for experimental and cave exploration work, because of the favorable climatic conditions, the extensive caves almost unknown, and the present state of its existing life.



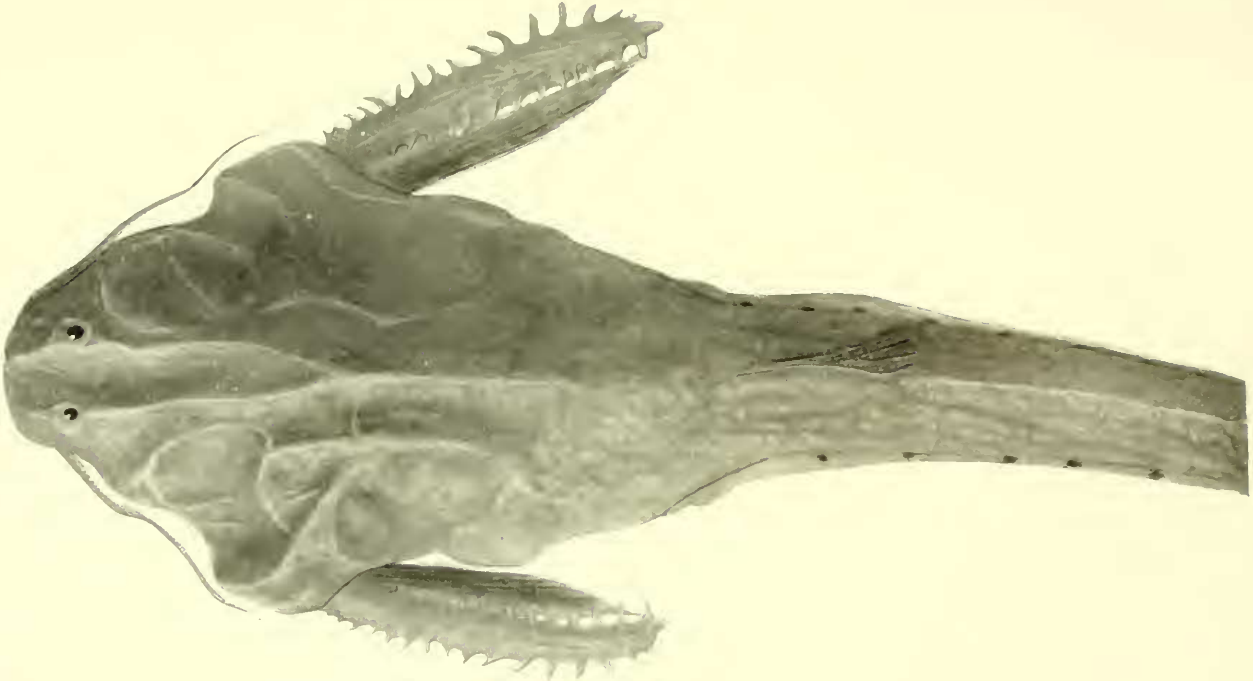
Cephalosilurus fowleri Haseman. *Type.* 405 mm. C. M. Cat. No. 2880.



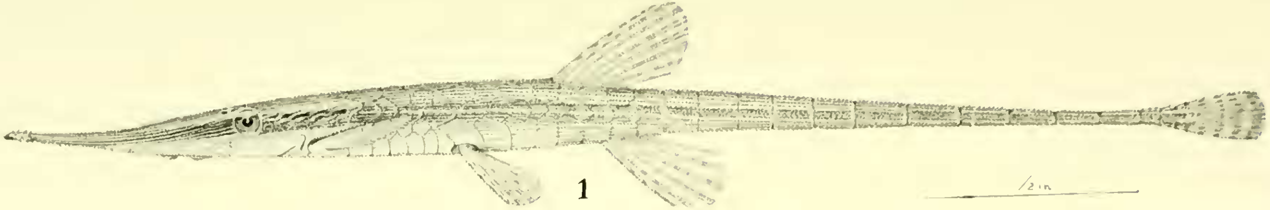
Imparfinis mirini Haseman. *Type.* 100 mm. C. M. Cat. No. 2981.

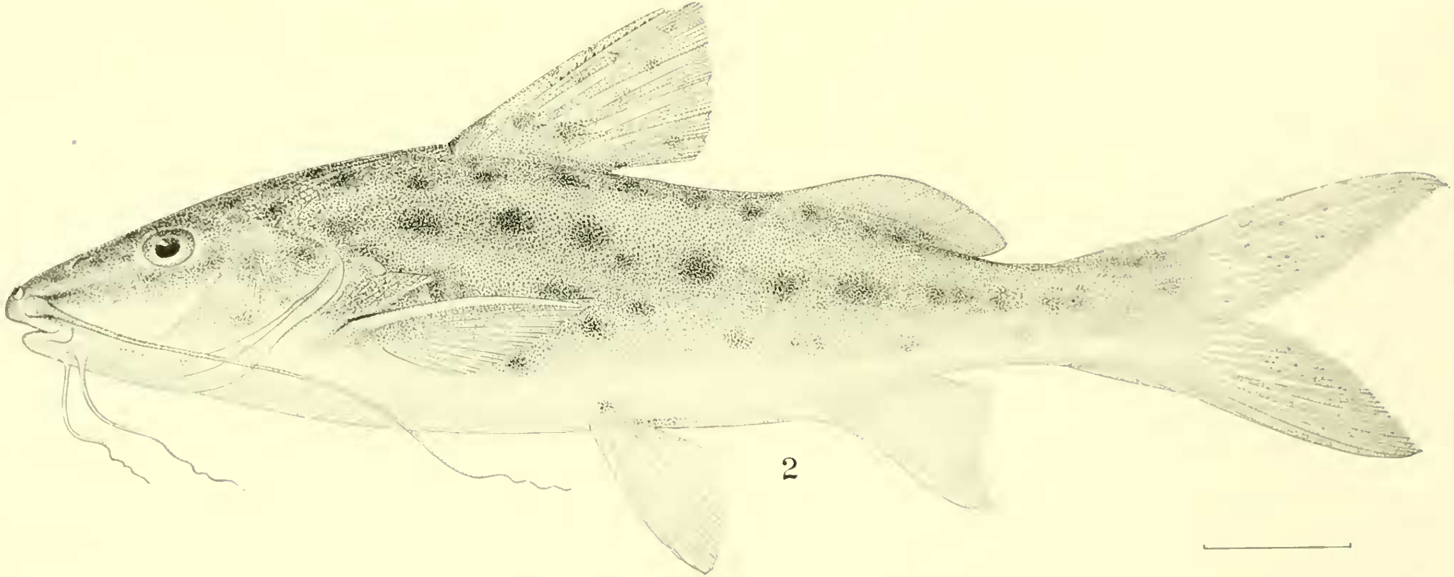


1. *Bunocephalus depressus* Haseman. *Type.* 65 mm. C. M. Cat. No. 2984.
2. *Imparfinis hollandi* Haseman. *Type.* 230 mm. to base caudal. C. M. Cat. No. 2864.

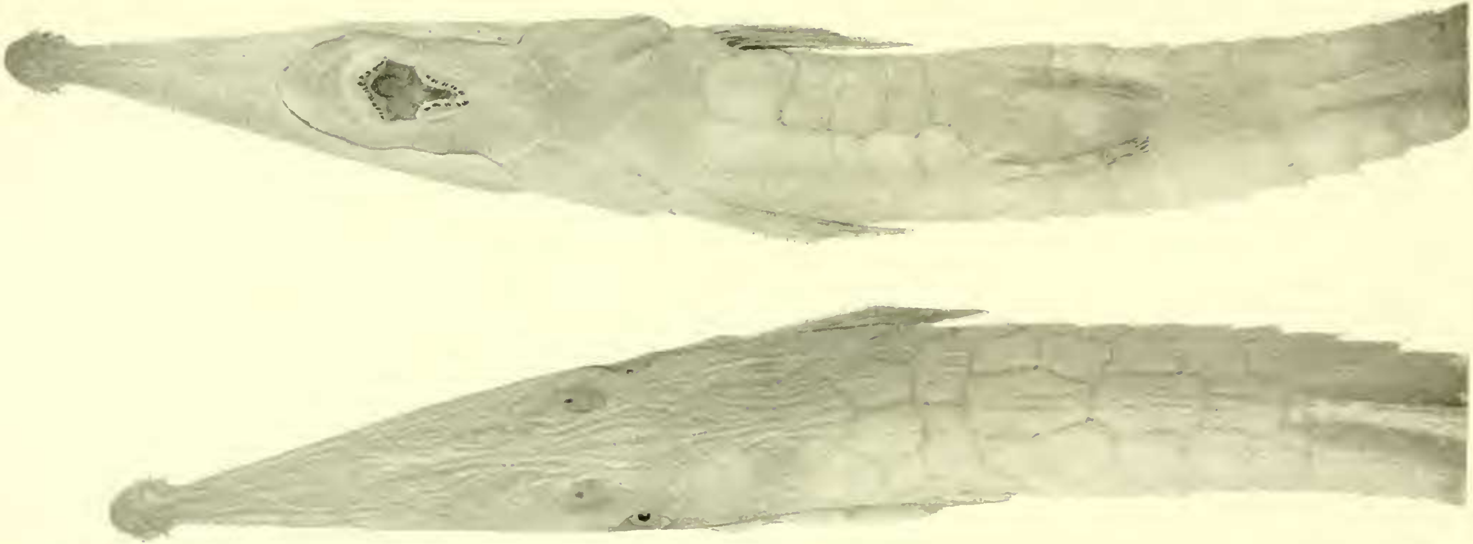


Bunocephalus depressus Haseman. Entire length 43 mm. C. M. Cat. No. 2984.





1. *Acestridium discus* Haseman. *Type.* 72 mm. C. M. No. 2985.
2. *Pimelodus ortmanni* Haseman. *Type.* 163 mm. C. M. No. 2857.



Dorsal and ventral views of head of *Acestridium discus* Haseman.